ATTACHMENT A

Remarks

By this Amendment, the specification and claims have been rewritten for better clarity. It is submitted that the present application is in condition for allowance for the following reasons.

Initially in the *Specification* section of the outstanding Office Action, the examiner required a substitute specification in proper idiomatic English. By this Amendment, a Clean Substitute Specification has been provided in Attachment B. In addition, a Marked Up Copy of the Clean Specification has submitted in Attachment C with markings showing all the changes relative to the immediate prior version of the specification of record. It is submitted that the substitute specification includes no new matter; which is readily evidenced by the marked up copy.

In the *Claim Rejections - 35 USC § 112* section, claims 1-10 were rejected for being indefinite; while in the *Allowable Subject Matter* section, it was indicated that claims 1-10 would be allowable if rewritten to overcome the § 112 rejection. Therefore, by this Amendment, claims 1-10 have been rewritten to be definite and to overcome the § 112 rejection. In view of these changes, it is submitted that claims 1-10 are now in immediate condition for allowance.

For all of the foregoing reasons, it is submitted that the present application is in condition for allowance and such action is solicited.

ATTACHMENT C

Marked Up Substitute Specification

Following herewith is a marked up copy showing the changes made from the previous specification to create the clean substitute specification contained in Attachment B.

BIT ASSEMBLY FOR A HAMMERING DRILL

FIELD OF THE INVENTION

[0001] The invention relates to a bit assembly for a hammering and rotating drill, ~~in which~~ The assembly includes a ~~the~~ main drill body ~~is~~ arranged to drill essentially ~~the~~ a middle portion of ~~the~~ a hole, ~~and~~ In the main drill body there is mounted one or more outer hammering bits ~~is~~ arranged to drill ~~the~~ an outer circle of the hole, ~~and~~ The ~~mentioned~~ outer ~~circle of the hole~~ drilling bits are arranged to drill a drilling surface, which is locateds ~~further~~ behind ~~in the drilling direction than for~~ the main drill body ~~meant~~ drilling surface, ~~and that~~ The ~~mentioned~~ outer bits are further mounted in ~~a~~ the main drill body in formed counter cavities, the axial directions of which ~~have~~ either ~~the~~ have a same direction as the drilling direction ~~has~~ or deviate outwards from it.

BACKGROUND OF THE INVENTION

[0002] ~~Earlier~~ There is known from patent publication FI-95618 a drilling apparatus in which ~~the~~ an outer circle of the hole drilling ring bit acts to drills ~~the~~ an outer circle, so that a casing tube can be pulled into the hole in connection with the drilling. However, when the drilling apparatus is pulled out from the hole so that the casing tube remains in the hole, the ring bit also has to remain in the hole bottom.

[0003] Also from patent publication FI-85302 there is known a drilling apparatus for drilling large holes in which ~~apparatus in~~ the centrer locating bit drills ~~the~~ a hole centrer portion, and separately on the outer circle of the drilling apparatus there are placed bits which drill the outer circle of the hole. The outer circle drilling bits ~~need in this case~~have rotating and hammering devices of their own. The drilling apparatus ~~can be applied~~is used for drilling of horizontal holes, so that ~~when it~~ the drilling apparatus is meant ~~finally~~ ultimately to penetrate through the ground into free space.

[0004] It is ~~abundantly~~ well known ~~with a casing tube drilling eccentric drills~~ where drilling is carried out by a rotating bit which is mounted eccentric in relation to a centrer axis of the casing tube, ~~and by means of which~~that it is possible to drill a larger hole than the diameter of the casing tube. When drilling is stopped, the eccentricity of the bit in relation to the centrer axis

of the casing tube is changed, so that the bit can be pulled out from the hole and the casing tube is left in the hole.

[0005] The disadvantage for ~~these known solutions is that in~~ these drilling apparatuses in which the ring bit ~~is~~ must be left in the hole~~,~~ is that there is then lost in every hole ~~always loosen~~a relatively expensive bit. The disadvantage when ~~used~~ an eccentric bit is used which must ~~the bit will~~ be lifted up from the hole~~,~~ is that ~~but~~ the bit will wear very quickly because the drilling surface in the bit is ~~remarkable~~ substantially smaller than the drilling surface of the hole, so that~~'s why~~ the worn bits have to be ~~often~~ changed often. In certain drilling apparatuses where the drilling bits can be pulled against each other thus allowing the bit assembly to be lifted up in spite of the casing tube, the disadvantage is that the mechanism by ~~means of~~ which the bits are pulled against each other has to be complicated, and it is difficult to change the bits and they can be very easily damaged.

SUMMARY OF THE INVENTION

[0006] By means of the bit assembly according to the invention, ~~in~~ the above noted ~~business area~~ existing problems can be unexpectedly solved~~.~~~~,~~ ~~and characteristics for~~ With the bit assembly according to the invention~~, is that in~~ there are counter cavities mounted outer bits which can be moved at least a part of their way out of the counter cavities ~~be transported out~~ in the direction which deviates from the axial direction of the counter cavity in order to make the outer diameter of the hammering drill~~ing unit~~ smaller.

[0007] The advantage for the bit assembly according to the invention is that ~~the~~ a large hole drilling, e.g., diameter 300 – 1000 mm, is possible by means of ~~the~~ hammering devices~~.~~~~,~~ This is possible ~~when~~ thanks to many separate outer hole drilling bits ~~in the drilling body~~ mounted ~~and only~~on the outer circle of the main hole drill~~ing~~ ~~bits~~body, so that the total drilling surface area of the main hole drill body ~~becomes~~ is smaller than the total front surface area of the drilled hole. Thus, the bit assembly does no~~'~~t need to be so effective and inconvenient~~ced~~ by a heavy hammer device, ~~than~~ as compared with corresponding drills whose bit is hammering against the whole drilling surface needed to provide the whole hole.

[0008] The separate outer circle drilling bits can also easily be changed. Further the outer circle drilling bits can be ~~according to the invention~~ mounted in the drill body in such a

way that when the bit assembly is pulled out from the hole, the bits ~~are moving~~move inwards at the casing tube edge. ~~and are thus~~ This ~~allowing~~ allows the pulling of the whole bit assembly out ~~and that~~while the casing tube remains in the hole. In the solution of the present invention, no expensive drill bit ~~is~~ remains~~ing~~ in the hole and drilling becomes more advantageous.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In the following the invention is more closely described by referring to the enclosed drawings, where

[0010] Fig. 1 shows a section view of the outer circle ~~of~~ hole drilling bit mounted in a drill body.

[0011] Fig. 2 shows a section view of an alternative bit mounting.

[0012] Fig. 3 shows a bit mounted according to figure 1 moving inwards at the casing tube.

[0013] Fig. 4 shows ~~a~~ the bit assembly of ~~the~~ fig. 1 seen from the front.

[0014] Fig. 5 shows an alternative bit assembly seen from the front.

[0015] Fig. 5a shows a section view of ~~the~~ an alternative bit mounting in a drill body.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Fig. 1 shows a main drill body 1 for a hammering drill which drills, by means of its drilling surface, at level L1, essentially ~~the~~ a centere portion of ~~the~~ a hole. Many smaller bits 2 have been mounted in the main drill body 1 for drilling ~~the~~ an outer circle of the hole. The fitting surface for each bit 2 is a curved counter surface or cavity 7 whose curvature can ~~also~~ be radius R. The bits 2 drills a hole whose diameter is little larger than ~~the~~ that required for a casing tube 4 ~~needs in order to be able~~ to follow ~~with~~ thereafter into the ~~a~~ drilled hole. ~~The~~ Each bit 2 is rotated~~ion piece~~ in relation to ~~its~~ an axis S of the associated counter surface 7 as shown, ~~that's why it can be~~so that the bit 2 rotates in ~~its~~ counter cavity 7. The rotation is ~~hoped~~ desired and ~~the rotation is secured~~ obtained by ~~it that~~having the drilling surface level L2 of the bit 2 ~~is~~ located ~~further~~ behind, in the drilling direction, ~~than~~ the drilling surface level L1 of the main drill body 1. ~~and~~ It will be noted that the bit 2 does no~~'~~t drill by any other portion other than ~~by~~ the bit portion which ~~in turn~~ is located~~s~~ in the outer edge of the circle beyond the main drill body 1. There is

depicted in figure 4 ~~presented~~ an area 9~~,~~ ~~by~~ which is the bit portion with which the bit 2 mainly drills. It will be appreciated that the rotation of the whole hammering drill~~ing~~ ~~unit~~ causes ~~that such~~ a moment ~~is~~ to be directed to ~~the~~ each bit 2, which moment causes ~~rotates~~ the bit 2 to rotate around ~~its own~~ the axis S.

[0017] The bit 2 can be mounted in the main drill body 1 by using ~~as a help~~ a separate bushing 5 which is placed into a hole drilled in the drill body 1. It is easier to machine in ~~this kind of~~ the bushing 5 and the needed counter cavities 7, ~~as~~ for example in the main drill body 1. In fig. 2 there is presented an alternative counter cavity assembly~~,~~ which is formed to be step-like. ~~Also~~ Consistent therewith, the bit 2' has ~~then~~ a step-like design as well. The mounting of the bit 2~~,~~ or 2' into the counter cavity ~~and~~ in the axial direction S ~~which describes this~~ as shown in the figures forms with the drilling direction preferably an angle α. The axial direction S of the counter cavity deviates ~~so~~ advantageously outwards from the drilling direction. The angle α is thus advantageously between 0 - 30°. The axial direction S of the counter cavity can possibly be the same as the drilling direction, as it is in the figure 5a. However, it facilitates a little the construction of the hammering drill ~~unit~~ if the angle α is larger than 0 as shown in figures 1-2.

[0018] ~~The~~ Figure 3 ~~presents~~depicts~~,~~ how the bit 2 of the bit assembly according to the invention is moved~~s~~ to the side ~~at~~ by the casing tube 4~~,~~ when the whole hammering drill ~~unit~~ is pulled out from the hole through the casing tube 4. The material of the arm 6 fixing the bit 2 ~~has been~~ is selected so that it allows the bit 2 to move out and to the side a needed distance as shown. The ~~form~~ shape of the counter surface 7 causes ~~that~~ the bit ~~also~~ to glides and turns inwards, so that ~~and~~ the bit 2 does no~~'~~t at all move out in the axial direction S ~~of the axis~~ of the counter cavity. The casing tube 4 thus accomplishes ~~carries out~~ the moving of the bit 2. When the whole hammering drill~~ing~~ ~~unit~~ has been ~~received~~ taken out from the casing tube, the bit 2 will then move back into its counter cavity. The fixing arm 6 is, for example, spring-like and therefore stretchy, and it is ~~needed~~ required that fixing arm 6 ~~it~~ will bend at least ~~in~~ at one point. It can be manufactured of pull resistant materials totally or combined, wherein it can comprise separately a stretchy portion and separately a bending portion. Rubbers, plastics, ~~fibre~~ fiber materials, steel springs or similar can ~~become in question~~be used. The bending of the fixing arm can also be ~~solved~~ accomplished by means of an articulated joint. In the drilling situation, the fixing arm 6

~~stresses~~ urges the bit 2~~, 3~~ against the counter cavity. The fixing arm 6 and a possible holder part 8 will preferable rotate with ~~when~~ the bit 2 when it rotates.

[0019] In figure 5 there is depicted a bit 3 which has an angular form, ~~wherein it~~and which does no~~'~~t rotate in its counter cavity. The moving of the bit 3 out of the cavity as pushed by the casing tube 4 can, however, happen ~~just~~ in the same way as ~~presented~~ described for bit 2 or 2' in figures 2 and 3 (i.e., based on the curved or step-like side form). The bits 3 ~~have~~ always have the same ~~portion~~ area in the drilling phase, ~~wherein~~ so that the~~y~~ bits 3 will wear a little sooner than the bits 2. The changing of the bits 2 and 3 takes, however, ~~quite~~ only a short time when the drill body 1 has been removed from the hole.

[0020] It will be appreciated that the bit assembly according to the invention becomes ~~the~~ cheaper as ~~the~~ larger holes are drilled. It will also be appreciated that the cent~~r~~er drilling surface ~~bit~~ will have a longer duration and smaller strain than if only one full-sized cent~~r~~er surface or bit ~~will have when~~ drilled the whole hole ~~only by that one bit~~. Also the power required for the hammer device can be smaller ~~of its power~~ when the ~~summarized~~ effective bit surface area does no~~'~~t correspond to the whole drilling surface ~~of the whole drilling~~. It will further be appreciated that the drilling of the hole ~~naturally~~ takes a little more time when carried out ~~by the way~~ according to the invention, as compared with drilling by ~~means of~~ one bit ~~by~~ using a heavy hammer device ~~which is needed~~.

[0021] In figure 5a there is depicted a section view of the unrotatable bit 3 where the bit 3 is located~~s~~ in its counter cavity. It will be appreciated that the axial direction S of the counter cavity is the same as the drilling direction. When the drilling unit is ~~begun to~~ pulled out from the hole, the front edge of the casing tube 4 pushes the bit 3 so that the bit 3 ~~begins to~~ turns to the cent~~r~~er axis of the drill body 1 as depicted by the arrow. The arm 6 thus stretches and bends ~~wherein~~ so that the bit 3 is able to pass by the casing tube.

ABSTRACT

A bit assembly for a hammering and rotating drill, in which ~~assembly the~~ a main drill body (1) is arranged to drill essentially ~~the~~ a middle portion of the hole and in the main drill body (1) there is mounted one or more ~~hammering~~ outer bits (2),(3) ~~is~~ arranged to drill ~~the~~ an outer circle of the hole. The outer ~~circle of the hole~~ drilling bits (2),(3) are arranged to drill an outer drilling surface~~,~~ which is located~~s~~ ~~further~~ behind a middle drilling surface of the main drill body in the drilling direction~~, than for the drill body (1) meant drilling surface (L1) and that~~ The ~~mentioned~~ outer bits (2),(3) are further mounted in ~~a~~ the drill body (1) in formed counter cavities (7), the axial directions (S) of which ~~have~~ are either the same direction as the drilling direction ~~has~~ or which deviate outwards from ~~it~~ the drilling direction. ~~and~~ The ~~mentioned~~ outer bits can be moved at least a part of the~~ir~~ way out of the counter cavities, in order to be ~~transported out~~moved in ~~the~~ a direction which deviates from the axial direction (S) of the counter cavity.